



Staying grounded? Applying the theory of planned behaviour to explore motivations to reduce air travel[☆]



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ABSTRACT

Air travel has been highlighted as a key environmental behaviour contributing to climate change. Given this, there is a surprising lack of theory-based research aimed at identifying factors that underpin motivation to reduce the number of flights taken. This study explored whether an extended theory of planned behaviour (TPB) model could be usefully applied to identify significant predictors of intentions to reduce the number of flights taken for leisure, holidays or to visit family or friends. Results supported the predictive utility of the TPB; the extended model was able to account for 52% of the variance in intentions over and above past behaviour and socio-demographic variables. Attitudes, subjective norms and behaviour-specific self-identity emerged as significant linear predictors. Findings support the utility of applying the TPB to air travel and suggest key variables which could be targeted in interventions to promote motivation to reduce the number of flights taken.

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1. Introduction

The anthropogenic nature of climate change is widely acknowledged (Stern, 2011), with the most recent report from the Intergovernmental Panel on Climate Change concluding that it is extremely likely that human activities have been the major cause of climate change since the mid-20th century (Intergovernmental Panel on Climate Change, 2013). The contribution of various environment-related behaviours to climate change differs substantially, however, and it has been argued that environmental psychologists should focus on those behaviours that have the greatest impact (Steg & Vlek, 2009; Stern, 2011).

The reduction of “unnecessary” air travel has been identified as one such key behaviour (Department for Environment & Rural Affairs, 2008), yet there is little evidence that individuals are motivated to reduce the number of commercial flights taken for leisure, holidays or to visit family or friends (Department for Environment & Rural Affairs, 2009). Furthermore, there is a notable lack of theory-based research aimed at identifying the factors that underpin motivation to reduce such air travel. Theory-based research in this area is necessary both to inform our understanding of the variables that influence motivations to reduce the number of flights taken and to guide the derivation of effective behaviour change interventions. Accordingly, the primary aim of the current study was to apply an extended theory of planned behaviour model (Ajzen, 1991) to identify key antecedents of intentions to reduce the number of flights taken for leisure, holidays or to visit family or friends.

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1.1. Air travel and climate change

Air travel makes a significant contribution to climate change. Indeed, in a report focusing on 12 “headline” environment-related behavioural goals – including those pertaining to personal transport, energy use in the home and waste-reduction – the [Department for Environment, Food and Rural Affairs \(2008\)](#) identified the avoidance of “unnecessary” (i.e., commercial, non-business) short haul flights as the behaviour with the highest environmental impact in terms of carbon dioxide equivalent (CO_{2e}) emissions. The potential contribution of air travel to climate change is compounded by the fact that greenhouse gases are emitted directly into the upper atmosphere, where they are thought to be more damaging than at ground level ([Penner, Lister, Griggs, Dokken, & McFarland, 1999](#)). Indeed, although the effects of these high altitude emissions are complex and difficult to calculate, it is thought that their overall impact should be weighted by a factor of 1.9–5.1 ([Sausen et al., 2005](#)).

Given the apparent impact of air travel on the environment, it is troubling that there is scant evidence for behaviour reduction in this domain. Between 1990 and 2008, aviation demand increased by around 130% ([Committee on Climate Change, 2009](#)), with leisure and holiday flights increasing by 185% (from 63 million to 180 million passengers per year) while business flights increased by 70% (from 25 million to 60 million passengers per year). This expansion in air travel has been facilitated by the increased network of airports, the relative cheapness of flights (compared to other travel modes), greater incomes and more available leisure time ([Gössling & Peeters, 2007](#)).

While airframe and engine design advances, operational efficiency improvements and the use of biofuels may contribute to the reduction of greenhouse gas emissions from aviation, the benefit of such technological advances will almost certainly be outstripped by increased consumer demand if the latter is not constrained ([Committee on Climate Change, 2009](#)). Accordingly, in the absence of fiscal policy and/or legislation designed to limit demand, a key challenge facing those concerned with mitigating the effects of climate change is how to persuade individuals to reduce the number of flights taken. This is particularly pertinent, given research findings suggest that people are not particularly motivated to limit their air travel. Thus the [Department for Environment \(2009\)](#) found that only 23% of their sample reported taking fewer flights for non-business related activities. By contrast, of those respondents who had flown in the previous 12 months, 36% had rejected the idea of reducing the number of flights taken, while 22% had not even considered making such a reduction.

A number of factors that might contribute to people's reluctance to limit their airplane use have been proposed, including a perceived right to fly in order to go on holiday ([Barr, Shaw, Coles, & Prillwitz, 2010](#); [Shaw & Thomas, 2006](#)) and a distinction being made between holidays and everyday life, where individuals are more willing to address the climate change impact of the latter ([Becken, 2007](#)). However, there is a surprising absence of systematic, theory-driven research exploring the salient factors that underpin motivation to reduce the number of flights taken. As the effectiveness of behavioural interventions in this area is likely to be contingent on their targeting such factors ([Steg & Vlek, 2009](#)), this would seem to be a notable omission to the literature. It has been argued that such research should be theory driven, as theory provides a framework that helps identify causal processes and – moreover – can facilitate the development of effective, replicable and parsimonious interventions ([Michie & Abraham, 2004](#); [Steg & Vlek, 2009](#)). Indeed, [Michie and Abraham \(2004\)](#) argue that “In the absence of a theoretical underpinning, intervention design is derived from implicit theories that may omit psychological processes central to behaviour change and so fail to optimize effectiveness.” (p. 33).

1.2. Air travel and the theory of planned behaviour

One widely-established and empirically supported model, which specifies the cognitive antecedents of behaviour, is the theory of planned behaviour (TPB; [Ajzen, 1991](#)). According to the TPB, the most immediate predictor of behaviour is behavioural intention, which reflects the individual's motivation to engage in the behaviour in question. Behavioural intention in turn is influenced by three further variables: attitudes, subjective norms and perceived behavioural control (albeit perceived behavioural control may also exert a direct effect on behaviour that is unmediated by behavioural intentions in some situations; [Ajzen, 1991](#)). Attitudes encapsulate the individual's overall appraisal of the behaviour as either positive or negative, subjective norms capture the individual's perception of whether significant others would want him or her to perform the behaviour and perceived behavioural control reflects the individual's belief that (s)he has control over performing the behaviour. In sum, if individuals evaluate a behaviour favourably, think that important others would like them to engage in the behaviour and believe that performance of the behaviour is under their control, then they should be more likely to hold positive intentions to engage in the behaviour and, consequently, be more likely to enact the behaviour.

In environment-related domains, the TPB has been successfully applied to the prediction of intentions across a variety of behaviours including recycling ([Mannetti, Pierro, & Livi, 2004](#); [Nigbur, Lyons, & Uzzell, 2010](#); [Terry, Hogg, & White, 1999](#)), ‘green’ hotel choice ([Han, Hsu, & Sheu, 2010](#)), environmental activism ([Fielding, McDonald, & Louis, 2008](#)) and the purchase of sustainably sourced foods ([Robinson & Smith, 2002](#)). Moreover, the TPB has been shown to effectively predict behavioural intentions in the context of transport mode choice, including both personal car use (e.g., [Bamberg & Schmidt, 2003](#); [Donald, Cooper, & Conchie, 2014](#); [Gardner & Abraham, 2010](#)) and public transport use ([Donald et al., 2014](#)).

By extension, it would seem reasonable to assume that the TPB might similarly provide a useful framework for identifying key determinants of intentions to reduce the number of flights taken for leisure, holidays or visiting family and friends. However, to the best of the authors' knowledge, only one published study to date has applied the TPB to any form of air travel. Thus, [Gatersleben, Murtagh, and Abrahamse \(2012\)](#) explored whether an extended TPB model could predict intentions

across a range of environment-related behaviours, including flying to one's holiday destination. Their findings regarding this latter behaviour indicated that the TPB was able to account for a significant proportion of the variance in intentions, with attitudes and perceived behavioural control emerging as significant linear predictors. However, this study's focus was restricted to one specific instance of air travel (flying to one's holiday destination), rather than assessing overall motivations to reduce the number of flights taken for leisure purposes. Furthermore, the TPB constructs were assessed using single item measures and some constructs were assessed in terms of non-sustainable behaviour (e.g., attitudes were assessed in the context of flying to one's holiday destination), while others were assessed in terms of pro-environmental behaviour (e.g., intentions were assessed in terms of *avoiding* flying to one's holiday destination). Thus, there would seem to be a need for research to systematically explore the utility of applying the TPB to the prediction of intentions to reduce the number of flights taken for leisure, holidays or visiting family and friends, utilizing multiple item measures of the core TPB constructs and adhering to the principle of compatibility in measurement (see Ajzen, 1988, 2006).

1.3. Self-identity

It has been suggested that the predictive utility of the TPB might be improved by the inclusion of additional predictor variables. Research findings indicate that *self-identity* might make a significant contribution to the prediction of intentions alongside the core TPB constructs (Rise, Sheeran, & Hukkelberg, 2010). Self-identity comprises "salient and enduring aspects of one's self-perception" (Rise et al., page 1087) and can be defined in terms of the labels that one ascribes to oneself (Cook, Kerr, & Moore, 2002).

In the context of applications of the TPB to environmental behaviour, self-identity has most frequently been operationalized in terms of the extent to which an individual perceives him or herself to be the sort of person who would engage in the behaviour under investigation. For example, an individual may see herself as the sort of person who recycles and, as a result of this behaviour-specific recycling self-identity, be more motivated to recycle (e.g., Terry et al., 1999). Such behaviour-specific self-identities have been shown to significantly contribute to the prediction of intentions over and above the core TPB constructs across a range of behaviours including recycling (Nigbur et al., 2010; Terry et al., 1999), environmental activism (Fielding et al., 2008) and the purchase of genetically modified foods (Cook et al., 2002).

To date there has been a paucity of research exploring whether behaviour-specific self-identity variables would similarly contribute to the prediction of intentions to engage in transport-related behaviours over and above the core predictors specified by the TPB. Nonetheless, there would seem to be no *a priori* reason why perceiving oneself as the sort of person who would want to reduce the number of flights taken should not similarly contribute to intentions to engage in this behaviour. This represents an important avenue for investigation.

It has also been suggested that self-identity in environmental domains can be usefully conceptualized at a more generic level, reflecting the extent to which an individual views him or herself as someone who is concerned with environmental issues (Gatersleben et al., 2012; van der Werff, Steg, & Keizer, 2013; Whitmarsh & O'Neill, 2010). Whitmarsh and O'Neill (2010) found that generic pro-environmental self-identity contributed to the prediction of intentions to engage in carbon offsetting behaviour over and above the core TPB predictors and a behaviour-specific measure of carbon-offsetting self-identity. This suggests that people's more general views of themselves as 'green' or 'concerned with environmental issues' might further contribute to the prediction of intentions to engage in pro-environmental behaviours. However, in the same study, Whitmarsh and O'Neill reported no significant association between pro-environmental self-identity and a cluster of transport-related behaviours, which included the reduction of non-essential short haul flights. By contrast, Gatersleben et al. (2012) found that a measure of pro-environmental self-identity (as an environmentally friendly consumer) did contribute to the prediction of intentions not to fly to one's holiday destination, over and above the core TPB predictors. However, neither study included a measure of behaviour-specific self-identity relating to airplane use. Accordingly, whether generic pro-environmental self-identity would contribute to the prediction of behavioural intentions over and above core TPB predictors and behaviour-specific self-identity in the context of air travel remains to be established.

1.4. Aims of the present research

In light of the information presented above, the aims of the current study were twofold. First, to establish whether the core TPB constructs of attitudes, subjective norms and perceived behavioural control would significantly predict intentions to reduce the number of flights taken for leisure, holidays or to visit family or friends. Second, to explore whether (i) behaviour specific self-identity (as the type of person who would reduce the number of flights taken) and/or (ii) generic pro-environmental self-identity would contribute to the prediction of intentions to reduce such flights over and above the core TPB components.

The decision was made to focus on flights taken for leisure, holidays or to visit family or friends for a number of reasons. First, in their classification of environment-related behaviours, the Department for Environment, Food and Rural Affairs (2008) highlighted the avoidance of such flights (albeit with a particular focus on short-haul destinations) as the behaviour with the greatest environmental impact. Second, such flights constitute approximately three quarters of all commercial air travel undertaken by UK citizens (Committee on Climate Change, 2009). Third, it seems intuitively plausible that individuals should have some say in terms of deciding whether or not they fly to go on holiday or to visit family and friends; by contrast, choice of transport mode and destination may be out of the individual's control in business-related contexts. We should note,

however, that we do not necessarily concur with the Department for Environment, Food and Rural Affairs' decision to identify such flights as "unnecessary" and, by implication, as more superfluous and readily avoidable than flights undertaken for other purposes (e.g., business travel).

2. Method

2.1. Participants

One hundred and ninety-four participants completed the questionnaire and met the inclusion criteria that they were aged 18 or over, currently resident in the UK and had flown at least once in the preceding 12 month period. The majority of the sample were employed ($n = 139$; 71.65%), were educated to at least undergraduate degree level ($n = 159$; 81.96%), had an annual household income of at least £40,000 ($n = 120$; 61.86%) and were of British nationality ($n = 164$; 84.54%). One hundred and six (54.64%) participants identified as female, 88 (45.36%) identified as male; ages ranged from 22 to 86 years ($M = 38.37$, $SD = 11.79$). The number of flights participants had taken over the previous twelve month period ranged from 1 to 62 ($M = 5.83$; $SD = 6.46$).

2.2. Measures

All participants completed an on-line questionnaire. At the start of the questionnaire, participants were informed that "The focus of the current research is on flights people take for the purpose of leisure, holidays or visiting family or friends, not those that people take for business or work purposes. Flights include any airplane travel to destinations within the UK (domestic flights), to other destinations within Europe (short haul flights) or to destinations outside Europe (long haul flights)".

All participants then completed the following measures:

2.2.1. Number of flights taken over the past 12 months

Participants were asked to respond to three questions assessing the number of (i) domestic, (ii) short haul and (iii) long haul flights that they had taken within the past twelve months for the purpose of leisure, holidays or visiting family or friends, e.g., "How many domestic flights (to destinations within the UK) have you taken in the past twelve months for leisure, holidays or visiting family or friends?". Participants were informed that a return flight counted as two flights. The total number of flights was calculated for each participant by summing the number of domestic, short-haul and long-haul flights they had taken in the past twelve months.

2.2.2. Past behaviour

Two items assessed whether participants had reduced the number of flights taken in the previous twelve month period: "Over the past twelve months I have reduced the number of flights I have taken for leisure, holidays or visiting family or friends" and "I have cut back on the number of times I have flown for leisure, holidays or visiting family or friends over the past twelve month period". Responses to both items were given on 7 point scales, ranging from *strongly disagree* (1) to *strongly agree* (7). These two items were found to be highly correlated, $r(192) = 0.91$, $p < .001$, and a mean score was calculated for each participant, with higher scores indicating that the individual was more likely to have reduced the number of flights taken over the past 12 months.

2.2.3. Attitudes

Participants' attitudes towards reducing the number of flights taken were assessed by asking them to respond to the statement "For me to reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months would be:" on each of the following five pairs of semantic differentials: *extremely bad* (1) to *extremely good* (7), *extremely harmful* (1) to *extremely beneficial* (7), *extremely worthless* (1) to *extremely valuable* (7), *extremely unpleasant* (1) to *extremely pleasant* (7) and *extremely unenjoyable* (1) to *extremely enjoyable* (7) (Ajzen, 2006). The resultant scale was found to have acceptable internal reliability, $\alpha = 0.85$, and a mean score was calculated for each participant, with higher scores indicating more positive attitudes towards reducing the number of flights taken.

2.2.4. Subjective norms

Participants' subjective norms towards reducing the number of flights taken were assessed by asking them to respond to the following three statements "Most people who are important to me think that I should reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months", "It is expected of me that I should reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months" and "The people in my life whose opinions I value would disapprove of my reducing the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months" (reverse scored) (Ajzen, 2006). Responses to all items were given on 7 point scales ranging from *strongly disagree* (1) to *strongly agree* (7). The resultant scale was found to have an unacceptably low level of internal reliability, $\alpha = 0.42$. Furthermore, the highest correlation between any pair of items was too low to justify combining

them to form a scale, $r(192) = 0.50$, $p < .001$. Accordingly, the item that was felt to best represent the underlying construct of subjective norms - “Most people who are important to me think that I should reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months” - was used as a single item measure of this construct in subsequent analyses.

2.2.5. Perceived behavioural control

Participants’ perceptions of control over reducing the number of flights taken were assessed by asking them to respond to the following four statements: “For me to reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months would be:” (*extremely impossible* [1] to *extremely possible* [7]), “If I wanted to, I could reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months” (*strongly disagree* [1] to *strongly agree* [7]), “I believe I have no control over reducing the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months” (reverse scored; *strongly disagree* [1] to *strongly agree* [7]) and “It is mostly up to me whether I reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months” (*strongly disagree* [1] to *strongly agree* [7]) (Ajzen, 2006). The resultant scale was found to have acceptable internal reliability, $\alpha = 0.74$, and a mean score was calculated for each participant, with higher scores reflecting higher perceptions of control over reducing the number of flights taken.

2.2.6. Intentions

Participants’ intentions with regard to reducing the number of flights taken were assessed by asking them to respond to the following three statements “I intend to reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months”, “I will try to reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months” and “I plan to reduce the number of flights I take for leisure, holidays or visiting family or friends over the next 12 months”. Responses to all items were given on 7 point scales ranging from *strongly disagree* (1) to *strongly agree* (7) (Ajzen, 2006). The resultant scale was found to have acceptable internal reliability, $\alpha = 0.93$, and a mean score was calculated for each participant, with higher scores reflecting stronger intentions to reduce the number of flights taken.

2.2.7. Behaviour specific self-identity

In line with previous research (e.g., Fielding et al., 2008; Terry et al., 1999; Whitmarsh & O’Neill, 2010), the following three items were used to assess behaviour specific self-identity: “Reducing the number of flights I take for leisure, holidays or visiting family or friends is an important part of who I am”, “I think of myself as the sort of person who would want to reduce the number of flights I take for leisure, holidays or visiting family or friends” and “I am not the type of person who would reduce the number of flights I take for leisure, holidays or visiting family or friends” (reverse scored). Responses to all items were given on 7 point scales ranging from *strongly disagree* (1) to *strongly agree* (7). The resultant scale was found to have acceptable internal reliability, $\alpha = 0.78$, and a mean score was calculated for each participant, with higher scores reflecting a stronger self-identity as an individual who would reduce the number of flights taken.

2.2.8. Pro-environmental self-identity

Based on Whitmarsh and O’Neill (2010), the following four items were used to assess generic pro-environmental self-identity: “I think of myself as being environmentally aware”, “I think of myself as someone who is very concerned with environmental issues”, “I would be embarrassed to be seen as having an environmentally friendly lifestyle” (reverse scored) and “I would not want my friends or family to think of me as someone who is concerned about environmental issues” (reverse scored). These four items were presented later in questionnaire, in order to avoid priming environmental concerns and hence influencing responses to the items assessing the theory of planned behaviour constructs and behaviour-specific self-identity. Responses to all items were given on 7 point scales ranging from *strongly disagree* (1) to *strongly agree* (7). The resultant scale was found to have tolerable internal reliability, $\alpha = 0.65$, and a mean score was calculated for each participant, with higher scores reflecting a stronger pro-environmental self-identity.

2.2.9. Demographic information

Participants were asked to indicate their age, gender, employment status, level of educational attainment, household income, nationality and country of residence.

2.3. Procedure and design

The current study employed a cross sectional survey-based design. Participants were recruited opportunistically via a recruitment message that was sent out to contacts of the first author and posted on the social networking site Facebook. The recruitment message invited prospective participants to take part in a short study exploring their beliefs about air travel and included the web link to the questionnaire. A snowballing recruitment technique was employed, where prospective participants were asked to forward the recruitment message to any other contacts whom they thought might be willing to take part.

3. Results

3.1. Preliminary analyses

Preliminary analyses (bi-variate correlations and oneway analyses of variance) were conducted to determine whether any of the following variables were associated with intentions to reduce the number of flights taken over the next twelve months: age, gender, employment status, educational attainment, household income, past behaviour and total number of flights taken in the past 12 months. These analyses indicated that employment status (operationalized in terms of whether participants were employed or otherwise), household income and past behaviour were each associated with behavioural intentions. Accordingly, these variables were controlled for in the analyses reported below.

3.2. Predicting intentions to reduce the number of flights taken using the TPB and Self-Identity

Bivariate correlations between the TPB predictors, measures of self-identity, intentions and past behaviour are given in Table 1, together with the ranges, means and standard deviations of these variables.

In order to test whether (a) TPB constructs and (b) measures of self-identity would predict intentions to reduce the number of flights taken, we conducted a hierarchical multiple regression analysis. Employment status (dummy coded with those not in employment allocated a value of 0 and those in employment a value of 1), income and past behaviour were entered at step 1, in order to control for any effects of these variables on intentions. Attitudes, subjective norms and perceived behavioural control were entered at step 2, to establish whether the core TPB constructs would significantly predict intentions to reduce the number of flights taken. Lastly, behaviour-specific self-identity and pro-environmental self-identity were entered in the model at step 3, to explore whether these variables contributed significantly to the prediction of intentions over and above the TPB predictors. Collinearity diagnostics revealed no evidence that the analysis suffered from problematic multicollinearity (all tolerances > 0.50, all VIFs < 2.00). The resultant hierarchical multiple regression is summarized in Table 2.

Step 1 predictors accounted for 20.41% of the variance in intentions, $F(3, 190) = 16.24, p < .001$. Past behaviour was the only significant linear predictor, with greater levels of prior flight reduction being associated with more positive intentions to engage in this behaviour in the future. When the TPB constructs were entered at step 2, the model accounted for an additional 41.56% of the variance in intentions, an increase which was found to be significant, $\Delta F(3, 187) = 68.13, p < .001$. Attitudes and subjective norms emerged as significant linear predictors at this step; individuals who held more positive attitudes towards reducing the number of flights taken and who believed that important others would approve of this behaviour held stronger intentions to enact the behaviour. Including the measures of self-identity at step 3 also significantly increased the variance in intentions that could be accounted for by the model, $\Delta F(2, 185) = 33.45, p < .001$; $\Delta R^2 = 0.10$. Behaviour-specific self-identity was the only self-identity variable to emerge as a significant linear predictor, such that perceiving oneself as the type of person who would reduce the number of flights taken was associated with more positive intentions to engage in this behaviour.

4. Discussion

4.1. The utility of applying the TPB to air travel

The findings of the present study support the position that the TPB might provide a useful framework for identifying key determinants of intentions to reduce the number of flights taken for leisure, holidays or visiting family and friends. Thus, the core TPB constructs of attitudes, subjective norms and perceived behavioural control were able to account for an additional 42% of the variance in behavioural intentions, over and above key socio-demographic variables and past behaviour. Specifically, attitudes and subjective norms emerged as significant linear predictors. In line with the predictions of the

Table 1

Bivariate correlations (Pearson's r), ranges, means and standard deviations for the TPB predictors, measures of self-identity, intentions and past behaviour.

Variable	2	3	4	5	6	7	Min.	Max.	<i>M</i>	<i>SD</i>
1. Attitude	0.46***	0.23**	0.61***	0.21**	0.71***	0.34***	1.00	6.20	3.54	1.02
2. Subjective norm		0.07	0.44***	0.01	0.56***	0.29***	1.00	7.00	2.68	1.32
3. Perceived behavioural control			0.04	0.13	0.20**	0.14*	2.00	7.00	5.28	1.08
4. Flying self-identity				0.30***	0.75***	0.38***	1.00	7.00	3.43	1.40
5. Environmental self-identity					0.24***	0.08	2.25	7.00	5.47	0.94
6. Intentions						0.43***	1.00	7.00	3.13	1.53
7. Past behaviour							1.00	7.00	3.20	1.85

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Hierarchical multiple regression of intentions on TPB predictors and measures of self-identity.

Step	Variables entered	β (Step 1)	β (Step 2)	β (Step 3)
1	Employment status	−0.06	−0.01	−0.03
	Household income	−0.10	−0.14**	−0.10*
	Past behaviour	0.41***	0.14***	0.07
2	Attitude		0.54***	0.33***
	Subjective norm		0.24***	0.17***
	Perceived behavioural control		0.05	0.09*
3	Behaviour specific self-identity			0.43***
	Environmental self-identity			0.00
R^2		0.20***	0.62***	0.72***
F		16.24***	50.79***	59.68***
ΔR^2			0.42***	0.10***
ΔF			68.13***	33.45***

Note: β represents the standardised regression coefficients.* $p < .05$.** $p < .01$.*** $p < .001$.

TPB, individuals who held more positive attitudes towards reducing their aviation and who believed that important others would want them to engage in this behaviour were more likely to intend to reduce the number of flights taken.

The finding that attitudes significantly predicted behavioural intentions in the current study is in line with previous applications of the TPB to other environmental behaviours, including household recycling (e.g., Terry et al., 1999), car use (e.g., Gardner & Abraham, 2010), environmental activism (Fielding et al., 2008) and the purchase of sustainably sourced foods (Robinson & Smith, 2002). It also supports Gatersleben et al.'s (2012) more closely aligned finding that attitudes predicted intentions in the context of flying to one's holiday destination.

By contrast, the finding that subjective norms significantly predicted intentions to reduce the number of flights taken is perhaps more surprising. Environmental applications of the TPB have not always found support for the hypothesized association between subjective norms and intentions. For example, while subjective norms were shown to contribute to the prediction of intentions in the context of environmental activism (Fielding et al., 2008), commuter transport mode (Donald et al., 2014) and visiting a 'green' hotel (Han et al., 2010), they did not predict intentions to recycle (Terry et al., 1999), travel by car (Gardner & Abraham, 2010) or fly to one's holiday destination (Gatersleben et al., 2012). Nonetheless, it seems intuitively plausible that the views of others might play an important role in influencing air travel in the context of flying to visit family and friends or to go on holiday. Thus, friends and families' thoughts and feelings are likely to be taken into account when deciding whether or not to fly to visit these individuals, particularly if avoiding air travel might preclude such visits. Similarly, if significant others' travel plans are impacted by one's aviation choices (e.g., regarding one's family holiday destination), it is likely that their views will influence the decision whether or not to reduce the number of flights taken.

Interestingly, the current study did not find perceived behavioural control to be significantly associated with intentions to reduce the number of flights taken at this step in the model (i.e., when it was entered alongside the core TPB constructs at step 2). This finding is contrary to other applications of the TPB to environmental behaviours, including flying to one's holiday destination (e.g., Donald et al., 2014; Fielding et al., 2008; Gatersleben et al., 2012; Han et al., 2010; Robinson & Smith, 2002; Terry et al., 1999). One possible reason why perceived behavioural control did not predict intentions at this step in the current study could be because the mean score for this construct was quite high ($M = 5.28$). Indeed, a frequency analysis revealed that 84% of participants scored above the scale midpoint, demonstrating that most participants perceived themselves to have relatively high levels of control over reducing the number of flights taken for leisure, holidays or visiting family and friends. The resultant lack of variability in participants' perceptions of control may have limited the capacity of this variable to predict intentions.

The fact that attitudes and subjective norms emerged as significant linear predictors of intentions suggests that these variables might usefully be targeted in interventions aimed at boosting motivation to reduce the number of flights taken for leisure or holidays, or to visit family or friends. Future research would benefit from systematically exploring the salient behavioural and normative beliefs that underpin attitudes and subjective norms in this behavioural domain (see Ajzen, 2006). One identified, these key beliefs could potentially inform the design of effective interventions to reduce air travel.

4.2. Self-Identity and air travel

The findings of the current study provide broad support for the position that measures of self-identity would contribute to the prediction of intentions to reduce the number of flights taken for leisure or holidays, or to visit family or friends, over and above the standard TPB variables. Thus, the two measures of self-identity included in the current study together accounted for an additional 10% of the variance in intentions.

More specifically, findings demonstrated that behaviour-specific self-identity was a significant linear predictor of intentions; individuals who saw themselves as the sort of person who would reduce the number of flights taken were more likely

to intend to engage in this behaviour. This finding compliments those of other studies in environmental domains, where behaviour-specific self-identity has been found to contribute to the prediction of intentions over and above the core TPB constructs (e.g., Cook et al., 2002; Fielding et al., 2008; Nigbur et al., 2010; Terry et al., 1999). It further suggests that this construct could profitably be targeted in interventions aimed at promoting motivation to reduce air travel, perhaps by priming or making salient this aspect of an individual's self-identity (see Bryan, Master, & Walton, 2014; Tarrant & Butler, 2011).

Conversely, there was no evidence that a general measure of pro-environmental self-identity contributed to the prediction of intentions to reduce the number of flights taken for leisure or holidays, or to visit family or friends, over and above the standard TPB variables. This finding contradicts that of Whitmarsh and O'Neill (2010), who found that their measure of pro-environmental self-identity contributed to the prediction of carbon offsetting over and above both the core TPB predictors and a measure of behaviour-specific self-identity. It is also discordant with Gatersleben et al.'s (2012) finding that a measure of pro-environmental self-identity (as an environmentally friendly consumer) contributed to the prediction of intentions not to fly to one's holiday destination, over and above the core TPB predictors, albeit this latter study did not include a behaviour-specific measure of self-identity.

4.3. Limitations and implications for future research

There are a number of limitations to the current study that should be acknowledged. It was not logistically possible to assess behaviour prospectively in the present study. As such we cannot definitively ascertain whether participants' intentions regarding reducing the number of flights taken translated into behaviour change. Meta-analyses of the TPB broadly support the capacity of behavioural intentions to influence behaviour (e.g., Armitage & Conner, 2001). Nonetheless, it would be prudent for future research to establish whether intentions to reduce the number of flights taken for leisure, holidays or to visit family or friends are associated with subsequent concordant reductions in air travel.

A further potential limitation concerns the generalizability of our findings. The use of the internet to collect data confers a number of advantages. Specifically, this medium has the potential to limit the influence of demand characteristics and response biases (Davis, 1999); furthermore, it can facilitate access to samples diverse in terms of age, gender and geographic location (Epstein, Klinkenberg, Wiley, & McKinley, 2001; Gosling, Vazire, Srivastava, & John, 2004). Nonetheless, the recruitment method employed in the present study – specifically the use of personal contacts of the first author combined with a snowballing technique – may have introduced bias, and the final sample is thus unlikely to be representative of the UK population. Indeed, the final sample over-represented those with a high level of educational attainment and a high annual household income. Although these people are arguably those most likely to fly to go on holiday or to visit friends or family (Committee on Climate Change, 2009; Gössling & Peeters, 2007; Kennedy, Krahn, & Krogman, 2014), and hence may represent those most in need of behaviour change interventions, future research would nonetheless benefit from utilizing a stratified sample of the general public.

In the present study, we elected to focus on flights undertaken for leisure purposes. However, it would be informative to explore whether the TPB variables would similarly predict business-related flying intentions. It seems likely that the role played by perceived behavioural control might differ in the context of business air travel compared to leisure travel. Specifically, one might expect some employees to have relatively low (perceptions of) control regarding whether or not they fly for business purposes. Perceptions of control might thus be an important determinant of intentions and behaviour in the context of business air travel.

4.4. Summary

In summary, this study represents the first systematic application of the TPB to the reduction of air travel for leisure, holidays or to visit family or friends. Findings support the contention that the TPB might provide a useful framework for identifying key determinants of intentions to reduce the number of flights taken. Thus, the core TPB predictors of attitudes, subjective norms and perceived behavioural control together accounted for a substantial amount of the variance in intentions, over and above key socio-demographic variables and past behaviour. Attitudes and subjective norms emerged as significant linear predictors of intentions in their own right. Furthermore, findings indicated that the inclusion of a measure of behaviour-specific self-identity alongside the core TPB constructs significantly augmented the predictive utility of the TPB in this behavioural domain. These findings can tentatively be interpreted to suggest that attitudes, subjective norms and behaviour-specific self-identity could profitably be targeted in interventions aimed at promoting motivation to reduce leisure air travel, however future research is required to establish the veracity of this proposition.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.trf.2018.02.038>.

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